

# RESERVE COPY PATENT SPECIFICATION



Application Date: May 27, 1942. No. 7613/42.

557,564

Complete Specification Left: May 19, 1943.

Complete Specification Accepted: Nov. 25, 1943.

## PROVISIONAL SPECIFICATION

### Improvements in or relating to Cylinders and Cylinder Heads of Internal Combustion Engines

#### ERRATUM

SPECIFICATION No. 557,564.

In the heading on page 1, for "No. 7613/42." read "No. 7163/42."

THE PATENT OFFICE,  
March 11th, 1944.

25 cylinder engine, the accuracy of machining required and troubles such as distortion of the cylinder head and the care and skill required to get the cylinder head bedded down with uniform pressure distribution.

30 The object of the invention is an improved construction of internal combustion engine in which the above mentioned disadvantages are substantially avoided.

35 According to the invention, an internal combustion engine comprising a piston and cylinder with detachable cylinder head and valve therein, is characterised in that the cylinder head and valve are embodied in a plug-like unit fitting into and adapted to be secured in the end of the cylinder or in an integral extension thereof.

40 According to a further feature of the invention, the cylinder is fitted with a liner which is additionally secured by the plug-like unit, and such construction may be further characterised by a gas sealing joint between the end of the cylinder liner and the plug-like unit.

50 According to a preferred embodiment of the invention, the valve is rotary and preferably constructed according to my prior Patent No. 463,412.

70 end of the cylinder extension, using suitable studs. Each plug-like unit is an easy but good fit in its socket and at its lower end it has a groove to hold a jointing ring, the upper end of the cylinder liner being similarly grooved for the same purpose. The plug-like unit is fitted with a conical rotary valve having an off-set combustion volume therein according to my aforesaid earlier Patent.

85 In conclusion, it will be seen that the construction and machining of the cylinder and plug-like unit is simple. Each plug-like unit is self-contained and self-located in its cylinder and the single jointing ring is simple besides being supported against blow-out because the good but easy fit of the plug-like unit supplements the resistance of the ring to momentary high internal pressures, such as occur in an internal combustion engine.

95 The invention is obviously not limited to all the details of construction of the example above described. For instance, the cylinder and its extension may be ribbed to provide air cooling fins and other modifications may be made without departing from the nature of the invention.

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## PATENT SPECIFICATION



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### PROVISIONAL SPECIFICATION

## Improvements in or relating to Cylinders and Cylinder Heads of Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention to be as follows:—

This invention relates to internal combustion engines and is particularly, though not exclusively, applicable to engines of the kind having a rotary valve and constructed according to the Specification of my earlier Patent No. 463,412.

The general principle of construction of a modern efficient internal combustion engine includes a detachable cylinder head and overhead valves therein, and while this form of construction has known advantages the greatest disadvantages lie in the cylinder head joint, its weakness, the elaborate and necessary system of holding-down bolts and, in a multi-cylinder engine, the accuracy of machining required and troubles such as distortion of the cylinder head and the care and skill required to get the cylinder head bedded down with uniform pressure distribution.

The object of the invention is an improved construction of internal combustion engine in which the above mentioned disadvantages are substantially avoided.

According to the invention, an internal combustion engine comprising a piston and cylinder with detachable cylinder head and valve therein, is characterised in that the cylinder head and valve are embodied in a plug-like unit fitting into and adapted to be secured in the end of the cylinder or in an integral extension thereof.

According to a further feature of the invention, the cylinder is fitted with a liner which is additionally secured by the plug-like unit, and such construction may be further characterised by a gas sealing joint between the end of the cylinder liner and the plug-like unit.

According to a preferred embodiment of the invention, the valve is rotary and preferably constructed according to my prior Patent No. 463,412.

Subsidiary features of invention are to be found in the description which follows.

In one example of the invention, a multi-cylinder-in-line engine comprises a unit construction wherein the cylinders and the upper part of the crankcase are in one piece. The cylinder is bored in two diameters, i.e. with a larger diameter at the cylinder head end, and is fitted with a cylinder liner, inserted from the outer end and having a flange located against a shoulder formed where the diameter changes, which is substantially at the end of travel of the piston. The cylinders are cored for cooling fluid and extend a substantial distance above the shoulder aforesaid so as to form a deep socket in the end of each cylinder.

A plug-like unit is located in each such socket, having a flange at its upper end by which it is adapted to be bolted to the end of the cylinder extension, using suitable studs. Each plug-like unit is an easy but good fit in its socket and at its lower end it has a groove to hold a jointing ring, the upper end of the cylinder liner being similarly grooved for the same purpose. The plug-like unit is fitted with a conical rotary valve having an off-set combustion volume therein according to my aforesaid earlier Patent.

In conclusion, it will be seen that the construction and machining of the cylinder and plug-like unit is simple. Each plug-like unit is self-contained and self-located in its cylinder and the single jointing ring is simple besides being supported against blow-out because the good but easy fit of the plug-like unit supplements the resistance of the ring to momentary high internal pressures, such as occur in an internal combustion engine.

The invention is obviously not limited to all the details of construction of the example above described. For instance, the cylinder and its extension may be ribbed to provide air cooling fins and other modifications may be made without departing from the nature of the invention.

Dated this 16th day of May, 1942.

For the Applicant,  
**WILSON, GUNN & ELLIS,**  
 Chartered Patent Agents,  
 54/56, Market Street, Manchester, 1.

### COMPLETE SPECIFICATION

## Improvements in or relating to Cylinders and Cylinder Heads of Internal Combustion Engines

I, FRANK METCALF ASPIN, a British subject, of Walmer Place, 149, Walmersley Road, Bury, Lancashire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to internal combustion engines and is particularly, though not exclusively, applicable to engines of the kind having a rotary valve constructed according to the Specification of my earlier Patent No. 463,412.

The general principle of construction of a modern efficient internal combustion engine includes a detachable cylinder head and overhead valves therein, and while this form of construction had known advantages the greatest disadvantages lie in the cylinder head joint with its inherent weakness and the elaborate and necessary system of holding-down bolts. In a multi-cylinder engine in particular, the accuracy of machining required and troubles such as distortion of the cylinder head and the care and skill required to get the cylinder head bedded down with uniform pressure distribution are all serious disadvantages.

The object of the invention is an improved construction of internal combustion engine in which the above mentioned disadvantages are substantially avoided.

According to the invention, an internal combustion engine comprises a cylinder extension, a cylindrical plug-like cylinder-head unit located therein, means for securing the plug-like unit against axial and rotational displacement, a rotary valve member mounted in the said plug-like unit with its axis of rotation longitudinal thereof, complementary tapered gas-sealing and bearing surfaces on the rotary valve member and in the said plug-like unit, the lower and larger end of the rotary valve member being at all times exposed to the cylinder, a driving stem at the other end of the rotary valve member driving means mounted thereon, and resilient means for axially loading the said complementary bearing surfaces.

According to a preferred embodiment of the invention, the valve is rotary and preferably constructed according to my prior Patent No. 463,412.

Subsidiary features of the invention are to be found in the description which follows.

In the accompanying drawing,

Fig. 1 is a sectional elevation of one example of the invention.

Fig. 2 is a similar view of a modified construction.

The example of the invention shown in Fig. 1 is one cylinder of a multi-cylinder-in-line engine of unit construction wherein the cylinders and the upper part of the crankcase (not shown) are in one piece. The cylinder 10 is bored in two diameters, i.e. with one diameter for the piston 11 (shown in chain line) and a larger diameter at 12 forming a socket at the cylinder head end. The cylinder is fitted with a cylinder liner 13, inserted from the outer end and having a flange 14 located against a shoulder formed where the cylinder diameter changes for the socket, which is substantially at the end of travel of the piston 11. Each cylinder is cored at 15 for cooling fluid and extends a substantial distance above the shoulder aforesaid so as to form a deep socket and integral with the end of each cylinder.

A plug-like unit 16 is located in each such socket, having a flange 17, at its upper end, by which it is adapted to be bolted to the end of the cylinder, using suitable studs such as 18. Each plug-like unit is an easy but good fit in its socket and at its lower end it has a groove to hold a jointing ring 19, the upper end of the cylinder liner 13 being similarly grooved for the same purpose. The plug-like unit 16 is shaped to house a conical rotary valve 20 having an off-set combustion volume therein which volume is not shown but constructed according to my aforesaid earlier Patent.

As will also be seen, the plug-like unit is shaped to house a bearing 21 for the driving gear wheel 22, splined on the end of the valve member. A spring 23 holds the conical valve member into its complementary conical seating in the plug-like unit. Naturally the plug-like unit

will have its port or ports, co-operating with the rotary valve member and in register with complementary ports in the end of the cylinder.

- 5 As shown in Fig. 2 the cylinder may be air cooled by having cooling fins 24 instead of being bored as at 15 in Fig. 1. Also, the cylinder is shown without a liner. The other parts of the construction which are the same as in Fig. 1 are given the same reference numerals.

10 In conclusion, it will be seen that the construction and machining of the cylinder and plug-like unit is simple.

15 Each plug-like unit is self-contained and self-located in its cylinder and the single jointing ring is simple besides being supported against blow-out because the good but easy fit of the plug-like unit supplements the resistance of the ring to momentary high internal pressures, such as occur in an internal combustion engine.

20 The invention is obviously not limited to all the details of construction of the examples above described, as modifications, other than those shown in Fig. 2, may be made without departing from the nature of the invention.

30 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An internal combustion engine having a cylinder extension, a cylindrical plug-like cylinder-head unit located therein, means for securing the plug-like unit against axial and rotational displacement, a rotary valve member mounted in the said plug-like unit with its axis of rotation longitudinal thereof, complementary tapered gas-sealing and bearing surfaces on the rotary valve member and in the said plug-like unit, the lower and larger end of the rotary valve member being at all times exposed to the cylinder, a driving stem at the other end of the rotary valve member, driving means mounted thereon, and resilient means for axially loading the said complementary bearing surfaces.

2. An internal combustion engine having a cylinder extension, a cylindrical plug-like cylinder-head unit located therein, means for securing the plug-like unit against axial and rotational displacement, a rotary valve member mounted in the said plug-like unit with its axis of rotation longitudinal thereof, complementary tapered gas-sealing and bearing sur-

faces on the rotary valve member and in the said plug-like unit, the lower and larger end of the rotary valve member being at all times exposed to the cylinder, a driving stem at the other end of the rotary valve member, driving means mounted thereon, resilient means for axially loading the said complementary bearing surfaces, and anti-friction bearing means in the plug-like unit for the driving means.

3. An internal combustion engine according to Claim 2, characterised in that the driving means is slidably mounted on the driving stem and in that the loading means comprises a spring between the end of the stem and the driving means having a reaction thrust operating through the said anti-friction bearing means.

4. An internal combustion engine according to any of the preceding Claims characterised in that the cylinder is fitted with a liner which is secured by the plug-like unit.

5. An internal combustion engine according to any of the preceding Claims characterised by a gas-sealing joint member between the end of the cylinder or cylinder liner and the plug-like unit.

6. An internal combustion engine according to any of the preceding Claims characterised in that the rotary valve is constructed according to my prior Patent No. 463,412.

7. An internal combustion engine according to any of the preceding Claims characterised in that the cylinder and cylinder end or extension is liquid cooled or provided with cooling vanes.

8. An internal combustion engine according to any of the preceding Claims characterised in that the plug-like unit is liquid cooled.

9. An internal combustion engine according to any of the preceding Claims characterised in that the plug-like unit and cylinder end or extension have at least one complementary and registering port.

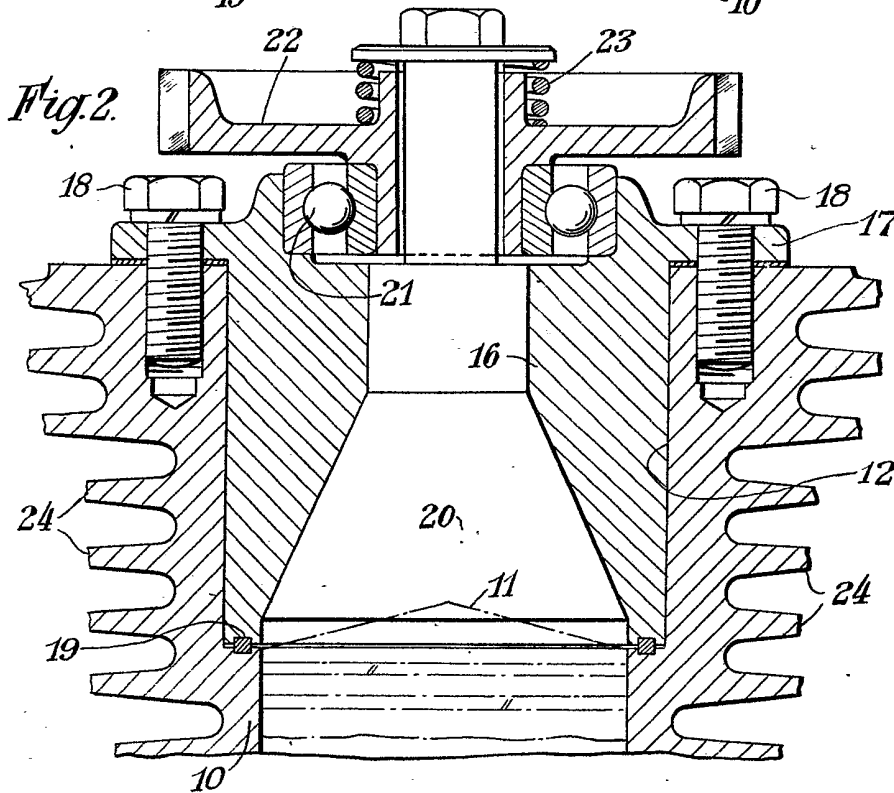
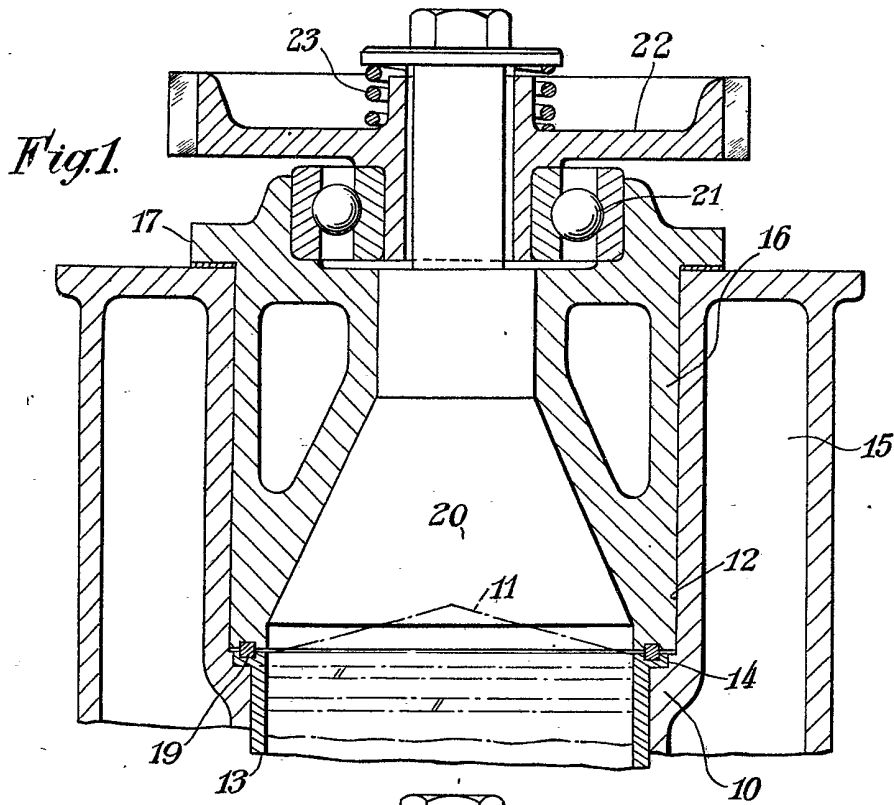
10. An internal combustion engine having a rotary valve mechanism constructed and arranged substantially as herein described with reference to and as illustrated in either figure of the accompanying drawings.

Dated this 6th day of May, 1943.

For the Applicant,

WILSON, GUNN & ELLIS,  
Chartered Patent Agents,

54/56, Market Street, Manchester, 1.



[This Drawing is a reproduction of the Original on a reduced scale.]